

**SECTION 31 23 23.15**  
**TRENCH BACKFILL**

**PART 1 GENERAL**

**1.01 REFERENCES**

- A. The following is a list of standards which may be referenced in this section:
1. American Public Works Association (APWA): Uniform Color Code for Temporary Marking of Underground Utility Locations.
  2. ASTM International (ASTM):
    - a. C33, Standard Specification for Concrete Aggregates.
    - b. C94/C94M, Standard Specification for Ready-Mixed Concrete.
    - c. C117, Standard Test Method for Materials Finer than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
    - d. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
    - e. C150, Standard Specification for Portland Cement.
    - f. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
    - g. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
    - h. D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve.
    - i. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
    - j. D3776, Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
    - k. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
    - l. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
    - m. D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
    - n. D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

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1.02 DEFINITIONS

- A. Base Rock: Granular material upon which manhole bases and other structures are placed.
- B. Bedding Material: Granular material upon which pipes, conduits, cables, or duct banks are placed.
- C. Imported Material: Material obtained by Contractor from source(s) offsite.
- D. Lift: Loose (uncompacted) layer of material.
- E. Pipe Zone: Backfill zone that includes full trench width and extends from prepared trench bottom to an upper limit above top outside surface of pipe, conduit, cable or duct bank.
- F. Prepared Trench Bottom: Graded trench bottom after excavation and installation of stabilization material, if required, but before installation of bedding material.
- G. Relative Compaction: The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by ASTM D1557. Corrections for oversize material may be applied to either as-compacted field dry density or maximum dry density, as determined by Engineer.
- H. Relative Density: As defined by ASTM D4253 and ASTM D4254.
- I. Selected Backfill Material: Material available onsite that Contracting Officer determines to be suitable for a specific use.
- J. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes producing a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.

1.03 SUBMITTALS

- A. Informational Submittals:
  - 1. Catalog and manufacturer's data sheets for compaction equipment.
  - 2. Certified Gradation Analysis: Submit not less than 30 days prior to delivery for imported materials or anticipated use for excavated

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- materials, except for trench stabilization material that will be submitted prior to material delivery to Site.
3. Controlled Low Strength Material: Certified mix design and test results. Include material types and weight per cubic yard for each component of mix.

**PART 2      PRODUCTS**

**2.01      GEOTEXTILE**

- A. As specified in Section 31 32 19.16, Geotextile.

**2.02      TRENCH STABILIZATION MATERIAL**

- A. Base Rock:
  1. Clean, hard, durable 3-inch minus crushed rock or gravel, or pit run, free from clay balls, other organic materials, or debris.
  2. Uniformly graded from coarse to fine, less than 8 percent by weight passing the 1/4-inch sieve.
- B. Granular Backfill:
  1. Clean gravel or crushed rock, reasonably well-graded from coarse to fine.

**2.03      BEDDING MATERIAL AND PIPE ZONE MATERIAL**

- A. Unfrozen, friable, and no clay balls, roots, or other organic material.
- B. Clean or gravelly sand with less than 5 percent passing No. 200 sieve, as determined in accordance with ASTM D1140, or gravel or crushed rock within maximum particle size and other requirements as follows unless otherwise specified.
  1. Pipe Under 18-Inch Diameter: 3/4-inch maximum particle size, except 1/4 inch for stainless steel pipe, copper pipe, tubing, and plastic pipe under 3-inch diameter.
- C. Pipe zone material to be Controlled Low Strength Fill within 10 feet of manholes and catch basins under pavement.

**2.04      EARTH BACKFILL**

- A. Soil, loam, or other excavated material suitable for use as backfill.

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- B. Free from roots or organic matter, refuse, boulders and material larger than 1/2 cubic foot, or other deleterious materials.

2.05 CONTROLLED LOW STRENGTH FILL

- A. Select and proportion ingredients to obtain compressive strength between 50 and 150 psi at 28 days in accordance with ASTM D4832.
- B. Materials:
  - 1. Cement: ASTM C150, Type I or Type II.
  - 2. Aggregate: ASTM C33, Size 7.
  - 3. Fly Ash (if used): ASTM C618, Class C.
  - 4. Water: Clean, potable, containing less than 500 ppm of chlorides.

2.06 AGGREGATE BASE

- A. ConnDOT Standard Specification Section M.01 Number 8 Aggregate.

2.07 TOPSOIL

- A. As specified in Section 32 91 13, Soil Preparation.

2.08 SOURCE QUALITY CONTROL

- A. Certify Laboratory Performance of Mix Designs:
  - 1. Controlled low strength fill.

2.09 CONCRETE

- A. As shown on Plans.

**PART 3 EXECUTION**

3.01 TRENCH PREPARATION

- A. Water Control:
  - 1. Promptly remove and dispose of water entering trench as necessary to grade trench bottom and to compact backfill and install manholes, pipe, conduit, direct-buried cable, or duct bank. Do not place concrete, lay pipe, conduit, direct-buried cable, or duct bank in water.
  - 2. Remove water in a manner that minimizes soil erosion from trench sides and bottom.
  - 3. Provide continuous water control until trench backfill is complete.

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- B. Remove foreign material and backfill contaminated with foreign material that falls into trench.

3.02 TRENCH BOTTOM

- A. Firm Subgrade: Grade with hand tools, remove loose and disturbed material, and trim off high areas and ridges left by excavating bucket teeth. Allow space for bedding material if shown or specified.
- B. Soft Subgrade: If subgrade is encountered that may require removal to prevent pipe settlement, notify Contracting Officer. Contracting Officer will determine depth of overexcavation, if any required.

3.03 TRENCH STABILIZATION MATERIAL INSTALLATION

- A. Rebuild trench bottom with trench stabilization material.
- B. Place material over full width of trench in 6-inch lifts to required grade, providing allowance for bedding thickness.
- C. Compact each lift so as to provide a firm, unyielding support for the bedding material prior to placing succeeding lifts.

3.04 BEDDING

- A. Furnish imported bedding material where, in the opinion of Contracting Officer, excavated material is unsuitable for bedding or insufficient in quantity.
- B. Place over the full width of the prepared trench bottom in two equal lifts when the required depth exceeds 8 inches.
- C. Hand grade and compact each lift to provide a firm, unyielding surface.
- D. Minimum Thickness: 4 inches.
- E. Check grade and correct irregularities in bedding material. Loosen top 1 inch to 2 inches of compacted bedding material with a rake or by other means to provide a cushion before laying each section of pipe, conduit, direct-buried cable, or duct bank.
- F. Install to form continuous and uniform support except at bell holes, if applicable, or minor disturbances resulting from removal of lifting tackle.

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- G. Bell or Coupling Holes: Excavate in bedding at each joint to permit proper assembly and inspection of joint and to provide uniform bearing along barrel of pipe or conduit.

3.05 WATER MAIN TRENCH BACKFILL

- A. Complete water testing procedures prior to backfilling.
- B. Restrain and support pipe as necessary to prevent movement during backfill operations.
- C. Concrete Encasement:
  - 1. Place as shown on Drawings.
  - 2. Discharge from truck-mounted drum-type mixer into trench.
  - 3. Place in lifts as necessary to prevent uplift (flotation) of new and existing facilities.
  - 4. Vibrate concrete with hand-held device to ensure that voids are completely filled around pipe.
  - 5. Fill the trench section as shown.
- D. Controlled Low Strength Fill:
  - 1. Place as shown on Drawings.
  - 2. Discharge from truck-mounted drum-type mixer into trench.
  - 3. Place in lifts as necessary to prevent uplift (flotation) of new and existing facilities.
  - 4. Fill the trench section as shown.
- E. After the low strength fill has reached specified strength, place remaining aggregate base material in 6-inch lifts, thoroughly compact the material by a minimum of three passes with a vibratory plate compactor. Backfill with proper allowances for pavement thickness.

3.06 BACKFILL PIPE ZONE

- A. Upper limit of pipe zone shall not be less than following:
  - 1. Pipe: 12 inches, unless shown otherwise.
- B. Restrain pipe as necessary to prevent their movement during backfill operations.

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- C. Place material simultaneously in lifts on both sides of pipe and, if applicable, between pipes, conduit, cables, and duct banks installed in same trench.
  - 1. Pipe 10-Inch and Smaller Diameter: First lift less than or equal to 1/2 pipe diameter.
  - 2. Pipe Over 10-Inch Diameter: Maximum 6-inch lifts.
- D. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by “walking in” and slicing material under haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.
- E. After the full depth of the pipe zone material has been placed as specified, compact the material by a minimum of three passes with a vibratory plate compactor only over the area between the sides of the pipe and the trench walls.
- F. Do not use power-driven impact compactors to compact pipe zone material.
- G. Controlled Low Strength Fill:
  - 1. Place within 18 inches of final grade within 10 feet of manholes and catch basins.
  - 2. Discharge from truck mounted drum type mixer into trench.
  - 3. Place in lifts as necessary to prevent uplift (flotation) of new and existing facilities.
  - 4. Fill the trench section as shown.

3.07 BACKFILL ABOVE PIPE ZONE

- A. General:
  - 1. Process excavated material to meet specified gradation requirements.
  - 2. Adjust moisture content as necessary to obtain specified compaction.
  - 3. Do not allow backfill to free fall into the trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over the top of pipe.
  - 4. Do not use power driven impact type compactors for compaction until at least 4 feet of backfill is placed over top of pipe.
  - 5. Backfill to grade with proper allowances for topsoil, crushed rock surfacing, and pavement thicknesses, wherever applicable.
  - 6. Backfill around structures with same class backfill as specified for adjacent trench unless otherwise shown or specified.

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B. Controlled Low Strength Fill:

1. Place within 18 inches of final grade within 10 feet of manholes and catch basins.
2. Discharge from truck mounted drum type mixer into trench.
3. Place in lifts as necessary to prevent uplift (flotation) of new and existing facilities.
4. Fill the trench section as shown.

3.08 REPLACEMENT OF TOPSOIL

- A. Replace topsoil in top 4 inches of backfilled trench.
- B. Maintain the finished grade of topsoil even with adjacent area and grade as necessary to restore drainage.

3.09 MAINTENANCE OF TRENCH BACKFILL

- A. After each section of trench is backfilled, maintain the surface of the backfilled trench even with the adjacent ground surface until final surface restoration is completed.
- B. Gravel Surfacing Rock: Add gravel surfacing rock where applicable and as necessary to keep the surface of the backfilled trench even with the adjacent ground surface, and grade and compact as necessary to keep the surface of backfilled trenches smooth, free from ruts and potholes, and suitable for normal traffic flow.
- C. Topsoil: Add topsoil where applicable and as necessary to maintain the surface of the backfilled trench level with the adjacent ground surface.

3.10 SETTLEMENT OF BACKFILL

- A. Settlement of trench backfill, or of fill, or facilities constructed over trench backfill will be considered a result of defective compaction of trench backfill.

**END OF SECTION**